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Research Article

THE ROLE OF TIME VARYING IN INTERCEPT OF THE CONDITIONAL ASSET PRICING MODEL: A STUDY ON EARNING YIELD RATIO

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ABSTRACT
During the recent decade, the asset pricing literature use conditional regressions to show the abilities of predictors and their interactions. However, the interpretations of the role of time varying in intercept of conditional asset pricing models are more contentious. Therefore, this paper investigates whether the conditional asset pricing models are well specified for time varying in intercept. We select the earning yield (EY) that has been applied as interaction term in many conditional asset pricing models. This study applies the ordinary least squares (OLS) method to estimate conditional asset pricing model for the period from January 2003 to January 2013. The result shows the predictors of asset pricing model are significant before making conditional by time varying in coefficients and intercept. However, when the conditional asset pricing model use the time varying in intercept, most of predictors become insignificant. Hence, the comparison results between the conditional asset pricing model with time varying intercept and without time varying intercept indicate that, the time varying in intercept increase biases in estimates of the conditional asset pricing model and make most of the coefficients insignificant. Moreover, the results show that the conditional asset pricing models are not reasonably well specified for time varying in intercept.

Keywords*: Conditional asset pricing model, time varying intercept, earning yield, interaction, return predictability.*

INTRODUCTION

The conditional asset pricing models use interactive regressions to test the power of predictors. In statistics, an interaction may arise when considering the relationship among three or more variables, and describes a situation in which the simultaneous influence of two variables on a third is not additive (Cox 1984). Most commonly, interactions are considered in the context of regression analyses in which known interactive regressions. The presence of interactions can have important implications for the interpretation of statistical models. If two variables of interest interact, the relationship between each of the interacting variables and a third "dependent variable" depends on the value of the other interacting variable. In practice, this makes it more difficult to predict the consequences of changing the value of a variable, particularly if the variables it interacts with are hard to measure or difficult to control. Interactive regressions play the role of time varying in coefficients and intercept of a model, therefore most of asset pricing studies apply interactive regressions to test the relationship between the asset pricing predictor and return depends on the value of another predictor.

This study uses the earning yield (EY) as the predictor that has been applied in many conditional asset pricing models (Kheradyar et al. 2011). This research applies the conditional methodology of Shanken (1985, 1990), and the ordinary least squares (OLS) method to estimate the conditional and unconditional asset pricing models, which is defined by Fama and French (1992, 1993). The conditional model allows the intercept and coefficients to vary with the earning yield ratio for the period from January 2003 to

January 2013. This study applies the coefficient diagnostics tests include Wald test, omitted redundant variables test, redundant variables test, the residual diagnostic tests include normality, serial correlation, heteroskedasticity, and stability diagnostic tests include the Quandt-Andrews breakpoint test, the Ramsey RESET test, the CUSUM test.

This study finds that the predictors of asset pricing model are significant before making conditional by time varying in coefficients and intercept. However, when the conditional asset pricing model use the time varying in intercept, most of predictors become insignificant. When time varying in intercept are suppressed and only time varying in coefficients are considered, the intercept is significant. Hence, the comparison results between the conditional asset pricing model with time varying intercept and without time varying intercept indicate that, the time varying in intercept increase biases in estimates of the conditional asset pricing model and make most of the coefficients insignificant. We suggest that the conditional asset pricing models are not reasonably well specified for time varying in intercept.

THE CONDITIONAL ASSET PRICING MODEL

The asset pricing models for returns, which use stock or portfolio to calculate returns, and the predictors, have long been a staple of asset pricing theory such as the Capital Asset Pricing Model (CAPM, Sharpe, 1964), the Asset Pricing Theory (APT, Ross, 1976), and the three factor model (Fama and French 1993). Historically, at first, studies identify variables for stock return predictability, and then latter studies use the same variables to test asset pricing models (Ferson et al. 2008). The beginning study that starts by Gibbons and Ferson (1985) suggest the conditional version of CAPM to test CAPM. The conditional version of CAPM focuses on time-varying of beta coefficient (β) in the following model:

$$R_t = \alpha + \beta R_{Mt} + \varepsilon_t \qquad (1)$$

Where, R_t is the return in t time period, α is the quantity of risk or intercept, β is the coefficient of model, R_{Mt} is market portfolio proxy in t time period, εt is the unsystematic error or a random error term. Therefore, if the time-varying of beta is $\beta_t = b_0 + b_1 Z_t$, where Z_t is lagged predictor variable, the conditional version of CAPM is as following:

$$R_t = \alpha_0 + b_0 R_{Mt} + b_1 R_{Mt} Z_t + \varepsilon_t \qquad (2)$$

Where, R_t is the return in t time period, α is intercept, b_0 and b_1 are time-varying coefficients of model, R_{Mt} is market portfolio proxy in t time period, Z_t is lagged predictor variable, ε_t is the unsystematic error or a random error term. The predictor variable of this study is earning yield (EY) ratio, which the prior studies lay emphasis on the effective relationship between stock return and EY, which clarify some unknown aspects of EY on stock return predictability. Such as, Tian and Zheng (2008) theoretically show the ability of EY to predict stock returns. Recently, some evidence supports the ability of EY in describing stock return (Kheradyar and Ibrahim 2011; Haider et al. 2012).

Soma main studies show that the conditional model (Eq.2) indicates a significant intercept (α_0) even after using time-varying of beta in CAPM models (Shanken 1990; Ferson & Schadt 1996). Indeed, the conditional asset pricing models increase return predictability, and Regressions remain reasonably well specified for conditional betas, even in settings where simpler predictive regressions are severely biased (Ferson et al. 2006). However, some previous studies overstate the significance of time varying alphas (Ferson et al. 2008). The results of testing CAPM show that the intercept of the conditional models (α_0) are smaller than the intercept of CAPM model (α) as the unconditional model. Additionally, the evidence statistically supports time-varying of beta in conditional models. Thus, the interpretations of the role of

time varying in intercept of conditional asset pricing models are more contentious. The question now is: Whether the conditional asset pricing models are well specified for time varying in intercept? That is the central question addressed by this study, which develop the following hypotheses:
H1: There is no significant intercept in the conditional asset pricing model of return and EY's return premium before time varying in intercept.
H2: There is no significant intercept in the conditional asset pricing model of return and EY's return premium after time varying in intercept.

Research Method
This research applies the ordinary least squares (OLS) method to estimate two regression models, which include conditional asset pricing model with time varying in intercept and without time varying in intercept. Therefore, consistent with Shanken (1990), this study makes the conditional asset pricing model (Eq.4) by time varying in intercept and coefficients of unconditional asset pricing model (Eq.3). The unconditional asset pricing model includes the EY's return premium (HMLDY) and market return (RM) has the following form:

$$R_{it} = \alpha_i + \beta_i R_{Mt} + e_i HML_{EY\,t} + \varepsilon_{it} \quad (3)$$

Where, Rit is the excess return of i th portfolio in t time period; αi is the estimated constant of i th portfolio; RMt is excess market return in t time period; βi is the coefficient of excess market return for i th portfolio; HMLEYt is the earning yield's return premium in t time period; ei is the coefficient of the earning yield return premium for i th portfolio; εit is the unsystematic error; i is the number of stock portfolios.
The unconditional asset pricing model refers to the implicit assumption that the intercept and coefficients of the model are constant over time. In contrast, the conditional asset pricing model permits the intercept and coefficients to vary with the earning yield ratio. Therefore, the conditional asset pricing model is made by combining the conditional regressions with the unconditional asset pricing model. The conditional regressions which are related to the intercept and coefficients of the unconditional asset pricing model (Eq.3) are as the following:

$$\alpha_{it} = \alpha_{i0} + \alpha_{i1} EY_{i(t-1)} \quad (4)$$

$$\beta_{it} = \beta_{i0} + \beta_{i1} EY_{i(t-1)} \quad (5)$$

$$e_{it} = e_{i0} + e_{i1} EY_{i(t-1)} \quad (6)$$

Where, α it, βit and eit are the intercept and coefficients of the unconditional two-factor model that to vary with the i th earning yield portfolio in t time period; α i0 , βi0 and ei0 are the estimated constants; α i1 , βi1 and ei1 are the coefficients of the i th earning yield portfolio, EYi(t-1) is i th earning yield portfolio in t-1 time period, i =1,2,3,…,n.
Finally, we substitute the conditional regressions (Eq.4,5,6) into the unconditional asset pricing model generates conditional asset pricing model. Thus, the conditional asset pricing model with time varying in intercept, which is applied for testing the first hypothesis, is as the following:

$$R_{it} = \alpha_{i0} + \alpha_{i1} EY_{i(t-1)} + (\beta_{i0} + \beta_{i1} EY_{i(t-1)}) R_{Mt} + (e_{i0} + e_{i1} EY_{i(t-1)}) HML_{EY\,t} + \varepsilon_{it} \quad (7)$$

When only the Equation (4) do not substitute at the unconditional asset pricing model (Eq.3), the conditional asset pricing model without time varying in intercept is created, which is applied for testing the second hypothesis as the following:

$$R_{it} = \alpha_i + (\beta_{i0} + \beta_{i1} EY_{i(t-1)}) R_{Mt} + (e_{i0} + e_{i1} EY_{i(t-1)}) HML_{EY\,t} + \varepsilon_{it} \quad (8)$$

This study comprises a period of 10 years, starting from 1, January 2003 to 1, January 2013. The dependent variable is stock return that is calculated by dividing the current price at the end of each month (Pt) by the current price at the end of last month (Pt-1). The independent variable is EY, as the EY is the earnings' rate per share divided by the current price at the required date, who is a reverse of the price-to-earnings ratio. The portfolios sorted by EY ratio, such as the breakpoints for each portfolio are determined by quintiles of all stocks, which include 5 portfolios per accounting ratio. The portfolios 1 and 5 are further dividend using 1 and 10 deciles of all stocks to make the lowest and highest portfolios. Therefore, there are 7 portfolios for each month of 10 years from January 2003 to January 2013 in Bursa Malaysia, which include a time series of 120 observations.

This study applies the coefficient, residual, and stability diagnostic tests. Coefficient diagnostics provide information and evaluate restrictions on the estimated coefficients, including Wald test, omitted and redundant variables tests. Residual diagnostic tests include normality, serial correlation, and heteroskedasticity in the residuals from the estimated equation. We explain three main stability tests, which include the Quandt-Andrews breakpoint test, the Ramsey RESET test, and the CUSUM test. This study uses the three unit root tests, which include the Augmented Dickey-Fuller (ADF) test, Phillips-Perron (PP) test, and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test for identifying non-stationarity variables.

Results

Table 1 shows the results of the first hypothesis that states that there is no significant intercept in the conditional asset pricing model of return and EY's return premium before time varying in intercept. The results indicate that the null hypotheses are rejected for the conditional asset pricing models of all portfolios at 5% significance level, which show all intercepts are significant. Accordingly, the conditional asset pricing model before time varying in intercept does a good job of explaining average abnormal returns (Petkova and Zhang 2005). The results also show that only the interaction variable of lowest portfolio is significant at 95% confidence level.

Table 2 shows the results of the second hypothesis that states that there is no significant intercept in the conditional asset pricing model of return and EY's return premium after time varying in intercept. The results indicate that the null hypotheses are accepted for the conditional asset pricing models of all portfolios at 5% significance level, which show all intercepts are not significant. The results also show that all the interaction variables are not significant at 95% confidence level. The results of the asset pricing conditional model without time-varying intercept (Table 1), which is supported with the findings of Ferson et al. (2008). Hence, If time varying in intercept are suppressed and only time varying in coefficients are considered, the intercept of the conditional asset pricing model is significant. The comparison results indicate that the time varying in intercept increase biases in estimates of the conditional asset pricing models and make most of the coefficients insignificant.

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Table 1 EY conditional model without time-varying intercept

$R_{it} = a_i + (r_{i0} + r_{i1}\, EY_{i(t-1)})\, R_{Mt} + (h_{i0} + h_{i1}\, EY_{i(t-1)})\, HML_{EYt} + e_{it}$

Portfolio	a_i		r_{i1}		h_{i1}		Adj.R^2 (%)
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	
Lowest	-1.15*	0.48	-0.08	0.06	-0.22*	0.11	70
1	-1.30**	0.39	0.10	0.06	-0.19	0.12	79
2	-1.02**	0.32	-0.03	0.10	0.04	0.15	83
3	-1.07**	0.37	0.02	0.11	-0.04	0.19	81
4	-1.21**	0.40	0.03	0.11	-0.02	0.19	77
5	-0.91*	0.45	-0.18	0.12	-0.23	0.25	77
Highest	-1.10*	0.46	-0.02	0.12	-0.17	0.26	76
Average	-1.01*	0.41	-0.02	0.09	-0.10	0.18	77.6

*, and ** represent respectively significance at 5% and 1% levels.

Table 2 EY conditional model with time-varying intercept

$R_{it} = a_{i0} + a_{i1}\, EY_{i(t-1)} + (r_{i0} + r_{i1}\, EY_{i(t-1)})\, R_{Mt} + (h_{i0} + h_{i1}\, EY_{i(t-1)})\, HML_{EYt} + e_{it}$

Portfolio	a_{i0}		a_{i1}		r_{i1}		h_{i1}		Adj.R^2 (%)
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	
Lowest	-3.43	3.25	-0.52	0.69	-0.04	0.07	0.05	0.17	75.3
1	-3.31	4.56	-0.48	1.09	0.06	0.11	-0.12	0.30	78.0
2	-2.10	3.58	-0.32	1.03	-0.05	0.11	0.09	0.25	85.3
3	0.05	3.89	0.37	1.22	0.02	0.13	-0.12	0.30	83.8
4	0.02	3.51	0.45	1.21	0.08	0.13	-0.11	0.30	79.7
5	0.06	3.25	0.56	1.42	-0.07	0.15	-0.09	0.36	77.7
Highest	0.14	2.72	0.49	1.27	0.00	0.14	-0.25	0.35	76.4
Average	-1.22	3.53	0.08	1.13	0.01	0.12	-0.07	0.29	79.4

*, and ** represent respectively significance at 10% and 5% levels.

Conclusion

Ferson et al. (2008) find that when the intercept and coefficient of predictor behave similarly in the conditional model, the bias leads to overstate the evidence for a time-varying in intercept, so the estimates of the conditional model without time-varying intercept are reasonably well behaved. Consistent with the evidence of Ferson et al. (2008), the comparison results indicate that the time varying in intercept increase biases in estimates of the conditional asset pricing models and make most of the coefficients insignificant. If the regressions use the interaction terms and time varying in intercept, most of predictors become insignificant. Moreover, if time varying in intercept is suppressed and only times varying in coefficients is considered, the intercept is significant. Thus, the conditional asset pricing models are not reasonably well specified for time varying in intercept.

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